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Observations on the Development of Ornithorhynchus.

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(Abstract.)

The paper treats of certain stages in the intrauterine development of the egg of *Ornithorhynchus*.

The stages dealt with include the following :—

- (1) An early (eight-celled) stage of segmentation.
- (2) A stage manifesting a later phase of the segmentation-process.
- (3) A stage of early germinal-layer formation, in which the cellular blastoderm is almost exclusively arranged in the form of a much-attenuated epithelial membrane covering part of the yolk-mass. The arrangement on the whole resembles that illustrated in fig. 22, Taf. 8, and fig. 33, Taf. 9, in R. Semon's work on "*Monotreme Development*."* Certain differences are, however, noticeable, more especially as regards the absence of the deeply placed nuclei figured by Semon.
- (4) A stage of more advanced germinal-layer formation, characterised by the complete differentiation of the yolk-entoderm and of a lenticular mass of cells connected with the outer layer of the vesicle, which would seem to represent an early condition of "primitive knot" formation. This stage represents that of the completed "first phase of gastrulation."
- (5) A stage exhibiting the characteristics of the "second phase of gastrulation." These include the presence of a fully-developed "primitive knot" which may henceforth be designated as "archenteric," owing to the formation in connection with it, by invagination, of an "archenteric," or "gastrulation-cavity." Meanwhile there has also developed—quite independently of, and

* '*Zool. Forschungsreisen in Australien*,' etc., 1894, Bd. 2, Lief. 1.

remote from, the primitive or archenteric knot—a primitive streak, of typically mammalian character.

(6) A stage which, for convenience of classification, is termed by the authors the “postgastrular.” This is characterised, *inter alia*, by the presence of a greatly elongated area of axial differentiation consisting of a primitive streak, together with a “Hensen’s knot” and a long “archenteric plate,” the two latter structures being derivatives of the “primitive” or “archenteric” knot of the preceding period. The archenteric plate ends anteriorly in an expanded “protochordal-plate” segment.

In this stage the primitive streak has practically retained its earlier form and dimensions, but it is now contiguous to, and has the appearance of being continuous with, the posterior end of the thickening of “Hensen’s” (archenteric) knot.

The “archenteric plate” is derived from the dorsal wall of a greatly elongated archenteric canal (*i.e.*, the archenteric invagination-cavity of the preceding stage). From this archenteric plate are derived both the chorda-Anlage and also, laterally to this, a small amount of “gastral” mesoderm.

(7) A “neurular” stage is described, in which the medullary plate is present as a completely flattened and spatulate structure. This is expanded, in the head-region, into a wider “cephalic plate.” This again is divisible into two divisions which seem to correspond to the “archencephalon” and the “deuteroencephalon,” respectively, of von Kupffer.

The cephalic plate further exhibits a series of neuromeric segments, all of which, with the exception of the most anterior, belong to the region of the “deuteroencephalon.” One neuromere, on account of its relations to the acustico-facial ganglion, is designated as “facial.” In front of this neuromere at least five “prefacial” neural segments are met with, whilst behind the same “facial” neuromere three definite “postfacial” neuromeres are encountered.

In the posterior region of the cephalic portion of the medullary plate, indications are to be found, in the case of slightly younger specimens, of the existence of additional “postfacial” segments behind the persistent 3rd postfacial neuromere.

Laterally from the margins of the cephalic medullary plate there are found, on each side, three ganglionic plate-like expansions of the “neural crest.” These represent the rudiments of the trigeminal, acustico-facial, and vago-glossopharyngeal ganglia.

The relations of these ganglionic plates with the various neuromeres are as follows:—The facial neuromere is connected with the “pedicle” of the acustico-facial ganglion, which at this period consists of a tract of cellular

tissue. Of the three definite postfacial neuromeres the 1st or most anterior has no recognisable ganglionic connection at the stages examined. The 2nd and 3rd postfacial neuromeres are connected laterally with the vago-glossopharyngeal ganglionic plate. Of the five prefacial neuromeres, the 1st, *i.e.*, the one immediately in front of the facial neuromere, has at no time any ganglionic connection, and lies opposite the hiatus between the trigeminal and the acustico-facial ganglionic plates. The next succeeding neuromeres in front of the 1st, *i.e.*, the 2nd to the 5th prefacial neuromeres, are each connected laterally with the broad basal portion, or wide "pedicle," of the trigeminal ganglionic plate.

The following points of more special interest amongst those set forth in the extended paper may here be specified.

(a) The very early differentiation of the layer of yolk-entoderm surrounding the yolk-mass of the monotreme egg.

(b) The original entire independence of the primitive streak from the primitive knot and its "gastrulation-cavity."

(c) The subsequent intimate approximation of these structures.

(d) The early appearance of an area of special differentiation in the vicinity of the primitive streak, in the early blastoderm; and the later conversion of this "primitive-streak-area" into an "embryonic area" proper, by the annexation of the region surrounding the "primitive" or "archenteric" knot.

(e) The precise mode of disappearance of the ventral wall, or floor, of the archenteric or invagination-cavity.

(f) The occurrence of peculiar segmental cell-masses in the substance of the "primitive knot," where that constitutes the parietes of an archenteric anal or its representative.

(g) The diagrammatically clear demonstration of various features of neural development, including: the well-marked neuromeric segmentation of the cephalic region of the flattened medullary plate; the differentiation of early plate-like ganglionic expansions of the neural crest in the cephalic region; the presence of various cellular connections between the cephalic ganglionic plates and certain of the neuromeric segments of the medullary plate.

(h) The relative insignificance of the "archencephalic" subdivision of the cephalic portion of the medullary plate, from which the fore-brain and most, if not all, of the mid-brain, are derived.
